

Application No.: 10/618,728
Amendment under 37 CFR 1.111
Reply to Office Action dated May 24, 2005
August 23, 2005

REMARKS

By this amendment, the specification has been editorially amended, claim 16 has been cancelled and claims 3, 5, 7-14, 17, 18-19 and 21 have been amended in the application. Currently, claims 1-15 and 17-22 are pending in the application.

Claims 3, 5, 8, 16 and 18-19 were rejected under 35 USC 112, second paragraph, as being indefinite. The Examiner stated that in claim 8, the phrase "according to 1" did not set forth the claim depends on. By this amendment, claim 8 has been amended to recite "according to claim 1".

The Examiner also stated that claim 16 set forth the same limitations as claim 15. By this amendment, claim 16 has been cancelled.

The Examiner also stated that claim 18, which depends from claim 15, recites the limitation "wherein the hue H in the Munsell color-system hue circle is 20 to 80" in lines 2 and 3. The Examiner believed that there was insufficient antecedent basis for this limitation in the claim. By this amendment, claim 18 has been amended to recite "the hue H in the Munsell color-system hue circle is 38 to 78". Applicants respectfully submit that the

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range "38 to 78" as amended in claim 18 is provided with sufficient antecedent basis based on the range "30 to 80" in claim 15.

The Examiner also stated that claims 3, 5 and 19 recited weight percentages, but they failed to indicate the object upon which these weight percentages are based. By this amendment, claim 3 has been amended to recite "the content of the white particles is 10 to 50% of a total weight of the modified red phosphorus, and the content of the color particles is 0.1 to 5.0% of the total weight of the modified red phosphorus". Also, claim 5 has been amended to recite "the red phosphorus content is 50 to 90% of a total weight of the modified red phosphorus". Also, claim 19 has been amended to recite "the red phosphorus content is at least 20% of a total weight of the modified red phosphorus". By these amendments, it is therefore respectfully submitted that this rejection has been overcome and should be withdrawn.

Claims 1-22 were rejected under 35 USC 103(a) as being obvious over Kobayashi et al. (U.S. Patent No. 5,543,444) in view of Japanese 2000-169119 (JP 2000-169119).

This rejection is respectfully traversed in view of the amendments to the claims and the remarks below.

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The present invention relates to modified red phosphorus, a method of producing the same, a decolorized red phosphorus composition capable of suppressing coloring in dark red peculiar to red phosphorus when kneaded with a resin, modified red phosphorus used for the decolorized red phosphorus composition and a production method therefor, and a flame-retardant polymer composition using the decolorized red phosphorus composition (see page 1, lines 6-13 of the specification).

Specifically, the present invention discloses that the modified red phosphorus comprises the red phosphorus-containing particles (A) whose surface are coated with the modified resin film (F) containing the white particles (B) having a specified whiteness, the color particles (C) having a specified hue range, and the binder resin (D).

The white particles (B) used in the present invention generally have a whiteness of 70 or more (see page 15, line 23 - page 16, line 5 of the specification). The white particles (B) serve as a component for concealing a dark red-brown color possessed by the red phosphorus particles (A1), adsorbing phosphine gas generated by decomposition of red phosphorus, and chemically fixing phosphorus oxoacids such as phosphoric acid, phosphorous acid, and the like generated by hydrolysis (see page

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16, lines 16-21 of the specification). Examples of the material for the white particles (B) are listed on page 16, line 21 - page 18, line 22 of the specification.

The color particles (C) have a hue H of 30 to 80 in the Munsell color-system hue circle (see page 19, lines 9-11 of the specification). In the present invention, the color particles (C) and the white particles (B) are dispersed in the binder resin (D) for forming the modified resin film (F) on the surfaces of the red phosphorus-containing particles (A), thereby effectively causing decolorization. In the present invention, green particles or blue particle are preferably used as the color particles (C) because the color of these particles is complementary to a red-brown color to decolorize a red color of red phosphorus by the color particles (C).

The method of producing the modified red phosphorus of the present invention is explained below. The first of all, an aqueous slurry is provided to contain with the red phosphorus-containing particles (A), the white particles (B) having a whiteness of 70 or more, and the color particles (C) having a hue H of 30 to 80 in the Munsell color-system hue circle. Next, a binder (D) resin is slowly combined with the aqueous slurry. Then, the binder resin (D) is cured with the white particles (B)

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and the color particles (C) on the surface of red phosphorus-containing particles (A).

Independent claims 1, 15 and 22 recite "A modified red phosphorus comprising red phosphorus-containing particles whose surfaces are coated with a modified resin film" and "a modified resin film containing white particles having a whiteness of 70 or more, color particles having a hue H of 30 to 80 in the Munsell color-system hue circle, and a binder resin".

Also, independent claim 9 has been amended to recite "A method for producing modified red phosphorus, said method comprising the steps of: providing an aqueous slurry containing red phosphorus-containing particles, white particles having a whiteness of 70 or more, and color particles having a hue H of 30 to 80 in the Munsell color-system hue circle; combining a binder resin with the aqueous slurry; and curing the binder resin containing the red phosphorus-containing particles, the white particles having a whiteness of 70 or more, and the color particles having a hue H of 30 to 80 in the Munsell color-system hue circle".

These features are not shown or suggested by Kobayashi et al. and JP 2000-169119 or any combination of these references.

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Kobayashi et al. relate to a red phosphorus flame retardant in fine powder form and a nonflammable resinous composition flame proofed with the flame retardant and having improved stability.

Kobayashi et al. disclose that an inorganic compound such as aluminum hydroxide, magnesium hydroxide, zinc hydroxide, and titanium oxide can be used to coat the red phosphorus particles (see col. 3, lines 25-29).

Kobayashi et al. also disclose coating the fine spherical red phosphorus particles with a thermosetting resin (see col. 3, lines 44-45).

Kobayashi et al. also disclose that after the resin is cured with the inorganic compounds on the surface of the red phosphorus, it is also possible to deposit a water-soluble inorganic compound on the resin-coated surfaces by merely adding a fine powder of the compound to the above described aqueous suspension and stirring the resulting mixture. Examples of the fine powder of the inorganic compound include silica, titanium dioxide, aluminum oxide, zinc oxide, magnesium oxide, magnesium carbonate, aluminum silicate, barium sulfate, calcium sulfate, calcium phosphate, apatite, talc, bentonite, kaolin, and diatomaceous earth (see col. 4, line 60 - col. 5, line 2).

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Kobayashi et al. do not disclose a modified resin film containing white particles having a whiteness of 70 or more, color particles having a hue H of 30 to 80 in the Munsell color-system hue circle, and a binder resin as claimed in claims 1, 15 and 22.

Kobayashi et al. also do not disclose a method for producing modified red phosphorus which comprises the steps of: providing an aqueous slurry containing red phosphorus-containing particles, white particles having a whiteness of 70 or more, and color particles having a hue H of 30 to 80 in the Munsell color-system hue circle; combining a binder resin with the aqueous slurry; and curing the binder resin containing the red phosphorus-containing particles, the white particles having a whiteness of 70 or more, and the color particles having a hue H of 30 to 80 in the Munsell color-system hue circle as claimed in claim 9.

In the Office Action, the Examiner specifically noted that the present invention discloses that the resin film used as the coating material contains 1) white particles having a whiteness of 70 or more, that may be composed of titanium dioxide; 2) color particles having a hue H of 30-80 in the Munsell color-system hue circle, wherein the particles may be green or blue particles; 3) a binder resin (see page 3 of the Office Action).

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Applicants respectfully submit that Kobayashi et al. do not disclose that a modified resin film containing both white particles and color particles is coated on the surface of the red phosphorus-containing particles by the binder resin as described in the present invention. Kobayashi et al. disclose that aluminum hydroxide, magnesium hydroxide, titanium hydroxide are used for coating the red phosphorus particles; however, these compounds are only white particles. Moreover, Kobayashi et al. disclose that silica, titanium dioxide, aluminum oxide, zinc oxide, magnesium oxide, magnesium carbonate, aluminum silicate are used for the post-treatment; however, these compounds are merely added on top of the resin-coated surfaces in powder form. Therefore, Kobayashi et al. do not show, suggest or disclose that both white particles and color particles are coated on the surfaces of the red phosphorus-containing particles by the binder resin as described in the present invention.

Also, applicants respectfully submit that when the resin-coated surfaces consist of white particles as described in Kobayashi et al., a reddish hue remains in the modified red phosphorus particles. Therefore, it is difficult to decolorize the modified red phosphorus particles to achieve more whiteness and it is also difficult to effectively suppress coloring in dark

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red peculiar to red phosphorus when kneaded with a resin as described in Comparative Example 1 of the present invention.

For these reasons, it is believed that Kobayashi et al. do not show or suggest the present claimed features of the present invention. Applicants also submit that JP 2000-169119 does not make up for the deficiencies in Kobayashi et al.

JP 2000-169119 and the present invention are commonly owned. JP 2000-169119 relates to a decolorized red phosphorus composition and method for producing the decolorized red phosphorus composition.

JP 2000-169119 discloses the method for modifying the surface of red phosphorus particles. The surface of the red phosphorus particles are coated with an inorganic compound by reacting a cationic water soluble resin and an anionic surfactant or nonionic surfactant.

JP 2000-169119 also discloses that the inorganic compounds are, for example, Zn, Al, Mg, Ti and related oxides, hydroxides or phosphates.

JP 2000-169119 also discloses that chromium oxide is added in the mixture of the modified red phosphorus particles, whose surfaces are coated with a resin and at least one or two compounds including titanium oxide, zinc oxide and apatite of the

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inorganic compounds as a white particle. Titanium oxide can also be added on top of the resin to decolorize the modified red phosphorus particles to achieve more whiteness.

JP 2000-169119 also discloses that 100 g of the red phosphorus covered with 10% titanium hydroxide were dispersed in 500 ml of water. 3.4 g of a cationic water soluble resin in terms of resin content was added to the resultant water dispersion, and then stirred for 30 minutes (A solution). 1 g of a nonionic surfactant was dissolved in 50 ml of water, and 20 g of titanium dioxide was dispersed in the resultant solution and then sufficiently dispersed by a paint shaker (B solution). The B solution was slowly added to the A solution over a time of about 1 minutes and then reacted at the room temperature for 60 minutes. After the completion of the reaction, the slurry was filtered with pure water by a conventional method, and dried at 110 degree for 6 hours (A sample). 150g of titanium oxide were added to the obtained modified red phosphorus and mixed them by the mixer. Decolorized red phosphorus were obtained by these processes (B sample). Next, 2.7 g of chromium oxide as a complementary color agent were added and mixed with the obtained decolorized red phosphorus (C sample).

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JP 2000-169119 does not disclose a modified resin film containing white particles having a whiteness of 70 or more, color particles having a hue H of 30 to 80 in the Munsell color-system hue circle, and a binder resin as claimed in claims 1, 15 and 22.

JP 2000-169119 does not disclose a method for producing modified red phosphorus that comprises the steps of: providing an aqueous slurry containing red phosphorus-containing particles, white particles having a whiteness of 70 or more, and color particles having a hue H of 30 to 80 in the Munsell color-system hue circle; combining a binder resin with the aqueous slurry; and curing the binder resin containing the red phosphorus-containing particles, the white particles having a whiteness of 70 or more, and the color particles having a hue H of 30 to 80 in the Munsell color-system hue circle as claimed in claim 9.

In the Office Action, the Examiner admitted that Kobayashi et al. and JP 2000-169119 are silent to the utilization of colored particles in the coating of the red phosphorus particles. However, the Examiner believed that it was known to include pigments in the process of coating the red phosphorus and it would have been obvious to include colored pigments in the process if some degree of coloration were desired.

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Applicants respectfully submit that JP 2000-169119 does not disclose, teach or suggest that a modified resin film could be altered to contain both white particles and color particles coated on the surface of the red phosphorus-containing particles by the binder resin as described in the present invention. The inorganic compounds used in JP 2000-169119 are only white particles and one of ordinary skill in the art would not have any reason to make a modification to the coating to include color particles.

Also, applicants respectfully submit that the modified red phosphorus of JP 2000-169119 is clearly different from the modified red phosphorus of the present invention in view of the different processes to make the modified red phosphorus and the decolorized red phosphorus composition as shown above. Specifically, JP 2000-169119 does not contain any color particles in the aqueous slurry, namely the B solution of JP 2000-169119. Moreover, JP 2000-169119 added chromium oxide to be mixed with the decolorized red phosphorus, namely the C sample of JP 2000-169119. This is different from the present invention because chromium oxide of JP 2000-169119 is not contained with the coated resin of the modified red phosphorus as shown in the present invention.

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Further, applicants respectfully submit that even though JP 2000-169119 discloses chromium oxide to add in the mixture of the modified red phosphorus particles and titanium oxide, both chromium oxide and the white particle are not coated on the surface of the red phosphorus particles by the binder resin. In other words, the chromium oxide is merely added on the resin-coated surfaces of the modified red phosphorus particles; therefore, JP 2000-169119 does not teach, suggest or disclose that both white particles and color particles are coated on the surfaces of the red phosphorus-containing particles by the binder resin as disclosed in the present invention. Moreover, the modified red phosphorus of the present invention is excellent for controlling the generation of phosphine gas. Also, the modified red phosphorus of the present invention is an excellent flame-retardant. In addition, the modified red phosphorus of the present invention is excellent for suppressing coloring in dark red peculiar to red phosphorus when kneaded with a resin.

It is therefore respectfully submitted that Kobayashi et al. and JP 2000-169119, individually or in combination, do not teach, disclose or suggest the presently claimed invention and it would not have been obvious to one of ordinary skill in the art to combine these references to render the present claims obvious.

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In view of foregoing claim amendments and remarks, it is respectfully submitted that the application is now in condition for allowance and an action to this effect is respectfully requested.

If there are any questions or concerns regarding the amendments or these remarks, the Examiner is requested to telephone the undersigned at the telephone number listed below.

Respectfully submitted,


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